MYCOLOGY.—*"Oedema," or "wart," of cultivated violet identified as scab.*[1] ANNA E. JENKINS, Bureau of Plant Industry, Soils, and Agricultural Engineering.[2,3]

This article reports the recent identification of "oedema," or "wart," of violet (*Viola odorata* L.) as the *Sphaceloma* disease now known as scab of violet (*11*). The work has involved historical research that has led to a better orientation of the almost unknown account of the "oedema," or "wart," published in 1899, as well as to a more complete documentation of what appears to be the only representative specimen. The existence of these early records was ascertained in 1932, during a preliminary study (*12*) of the scab. At that time, however, material was insufficient to permit the tracing of this fungus malady to the "oedema." As the name connotes, this was thought to be of physiologic origin. Recently, when it became a question of identifying the "oedema" as scab, ample material of the scab was available for comparison. Assembled from various places and representing the disease on wild, as well as cultivated, violet (*10, 11*), these specimens show the range of symptoms that may be exhibited by this highly disfiguring and destructive disease.

The account of the oedema now comes to the fore not only as the first known record of violet scab, but also as one of the few *Sphaceloma* diseases encountered in the United States during the early phytopathological period. It may be stated, then, that through the effort herein recorded another advance has been made in the reconstruction of the history of plant diseases caused by *Sphaceloma*. This paper elaborates upon an aspect of early pathological history emanating from the U. S. Department of Agriculture, although barely apparent in its annals.

HISTORICAL BACKGROUND

Extraordinary interest in violets at the turn of the century is expressed in the separate section entitled "Violets" in Dr. Galloway's first annual report as chief of the Bureau of Plant Industry (*6*, p. 89, also see *14*). The pertinent passage from Galloway is quoted as follows:

> As a result of the demand for the violet and the price which it commands in the market, nearly every person interested in a general supply of cut flowers, grows or attempts to grow violets, while many others make violet culture their specialty and main dependence. In consequence of the many failures which are annually reported in this line, the work of the Experimental Gardens and Grounds has been extended to include a test of methods of culture and varieties of violets best suited to commercial growing. As a beginning in this direction two houses have been erected and so arranged that the various conditions of soil, heat, and moisture demanded by the violet can be studied. A variety collection, comprising all of the commercial sorts of both the United States and Europe, has been brought together for the purpose of determining their fitness for commercial work and their value as parent stock for new varieties.

Throughout his earlier chiefship of the phytopathological division already named, Dr. Galloway was actively concerned with diseases of violets grown under glass. This is shown by brief mention of the subject in most of his annual reports for the period, viz., 1890–1900.

Investigations of violet diseases were car-

---

[1] Received July 12, 1944.

[2] This paper was presented at the meeting of the Potomac Branch of the American Phytopathological Society held at the Plant Industry Station, Beltsville, Md., on February 23–24, 1944. The abstract will be published in Phytopathology.

[3] Certain historical facts reported in this article, not available from other sources, were obtained over a period of years in various personal conferences with Drs. B. T. Galloway and A. F. Woods and Messrs. W. E. Taylor, David Bissett, and J. W. Byrnes as former or present members of the U. S. Department of Agriculture. During the period with which this paper deals, Dr. Galloway was chief of the Division of Vegetable Pathology, renamed in 1895 (*4*, p. 169) the Division of Vegetable Physiology and Pathology (*16*). Dr. Woods joined Dr. Galloway's staff as physiologist in 1893 (*16*). In the same year Mr. Taylor entered the division as Dr. Galloway's clerical assistant. The two greenhouse floriculturists, Messrs. Bissett and Byrnes, in 1904 and 1906, respectively, became members of the Bureau of Plant Industry in which the "Department's work on plants was consolidated" in 1901 (*15*, p. 197) with Galloway as chief. It is a pleasure to acknowledge here the helpful assistance freely given at one time or another during the present study by all those mentioned. It is proper to mention that Dr. Woods was in attendance during the morning session, February 23, when this paper was presented.

ried out by the division not only in the laboratory and "Department greenhouse" (*cf.* *3*, p. 11), but also in certain violet houses at Garrett Park, Montgomery County, Md.[4] (*cf.* *3*, p. 11). These were built about 1894–95 by Dr. Galloway and P. H. Dorsett[5] and were privately owned and operated by them until about 1898; thereafter solely by Dorsett. At Dorsett's request about 1900 the violet houses were purchased by Mr. Bissett. He had received exceptional training in floriculture and had had wide experience in violet culture. In part, the original violet houses were destroyed by fire about 1904 (*7*, p. 237); Mr. Bissett constructed others, again in Garrett Park, and there continued with his specialty until about 1930. The blooms produced in his houses commanded the highest prices in large city markets and members of the Bureau familiar with the work still attest to their exceptional beauty, size, and fragrance. He has been, therefore, deservedly regarded as one of the most outstanding specialists in violet culture.

GALLOWAY'S TREATISE ON VIOLET CULTURE

Galloway's book on *Commercial violet culture*, published in three editions (*5*), commemorates his and Dorsett's experience in growing violets under glass. To quote from the preface to the first edition (*5*, 1899):

"I wish to express my thanks to Mr. P. H. Dorsett, who shared with me all the trials and vexations which fall to the lot of the beginners in this work. He is now a successful grower and many of the illustrations given are from his houses."

The numerous illustrations (61 halftones) in the first edition are reproductions from photographs made by Mr. Dorsett, as Messrs. Bissett, Byrnes, and Taylor affirm. This explains the source of the photograph of the "oedema," or "wart," to be mentioned later.

The book does not mention the location of the violet houses, but this is known to have been at Garrett Park, as already indicated. This is definitely mentioned by Galloway in his separate article already cited (*7*), in which he specifies that the varieties grown at Garrett Park were chiefly Lady Hume Campbell and to a lesser extent Marie Louise.

Chapter 8, or nearly one-fourth of the text, deals with "Diseases and Insect Enemies." This chapter embodies the investigations of the trio of scientific workers, Galloway, Dorsett, and Woods, as Dr. Woods has verified and as may be deduced from Galloway's direct reference to "Messrs. Albert F. Woods and P. H. Dorsett, who have been associated with the writer in work on plants under glass. . . ."

THE "OEDEMA"

The account of the "oedema," or "wart," with which this article is particularly concerned, is precisely the same in all three editions of Galloway's *Commercial violet culture* (*5*, ed. 1, pp. 182–185, fig. 55; ed. 2, pp. 186–188, fig. 57; ed. 3, pp. 193–194, fig. 59). Coon's *Practical violet culture* (*2*) is essentially a successor to this early treatise by Galloway and admittedly draws heavily upon it. But there is here no direct reference to the "oedema" in the much reduced discussion corresponding to Galloway's chapter 8. Gregory and Davis's (*9*) mention of "oedema" or "dropsy" clearly is taken from Galloway.

The section on "oedema" in Galloway's book is here quoted in full:

> Oedema, or Wart Disease. This trouble often proves quite serious, but is easily kept under control by the proper handling of the plants. The affected plants show wart-like growths over the leaves, and these are usually of a brownish color. These warty growths vary in size, some of them being quite small and others one-eighth of an inch long and one-sixteenth of an inch high. The corky growths are not confined wholly to the leaves. In fact, they frequently occur on the leaf stalks, and sometimes on the flower stalks also. It is found that where these warty formations are developed the whole leaf is in a peculiar condition. It is brittle, and when taken in the hand cracks very easily. The leaves, in other words, instead of having a live, elastic feel, appear to the touch to be dry like a shaving, and when bent will break with a cracking noise. Wherever a break of this kind occurs the corky growth appears in time. The corky formations may also develop wherever an

---

[4] Garrett Park is in the Rock Creek Valley, about 12 miles northwest of the District of Columbia.

[5] Mr. Dorsett was a member of Dr. Galloway's early phytopathological staff (*16*).

> insect punctures the leaves. The punctures of aphides and the bites of spiders cause many of these swellings. When the plants get into this condition it is practically unfit for flowering, and when badly diseased it is very difficult to ever get it into proper shape again. The trouble is one that is brought on gradually by improper relations between the moisture of the soil, moisture of the air, and the light.
>
> Where plants are mulched and the soil kept constantly wet the trouble is likely to follow, especially if heavy shading is adopted. Where the plant is grown for some time under these conditions all of its tissues get into a dropsical or oedemic state, and it needs only an injury of some kind to cause the formation of the wart-like growths. If the conditions are very favorable, injuries are not necessary for the wart-like growths, as they will be produced by the plant without intervention of anything of this kind. This is due to the fact that the plant is really making an abnormal effort at growth, and the warts are nothing more than excessive growth of the cells at particular points. This trouble seldom occurs in houses properly lighted and ventilated. In underground pits, and in outdoor frames where heavy shading is used, it is apt to occur, especially if the practice of mulching is adopted.
>
> By paying proper attention to light, ventilation, and watering, little or no difficulty is experienced from the trouble. In case it is seen that plants are becoming oedemic it will be necessary to modify at once the surroundings to such an extent as to admit more light to the leaves and more air to the soil. It will not do, however, to bring about these changes too rapidly. Light should be gradually given, and the amount of water added to the soil should be slowly diminished. If the change is too abrupt, serious consequences may result, as the plant, having been grown under such abnormal conditions, is not able to withstand the unusual exposure to bright light and dry soil, which the sudden change might bring about.

Bearing the legend "oedema, or wart disease," an accompanying illustration, unfortunately indistinctly reproduced, represents the lower surface of a fresh, severely diseased leaf blade. Careful comparison reveals that the illustration corresponds so closely to the leaves of the specimen of the "oedema" mentioned in the introduction of the present paper (Fig. 1, *D*) that it could well represent them, i.e., when freshly gathered.

This historic specimen, undated and without a formal label, was included among the physiological specimens of the Mycological Collections of what is now the Bureau of Plant Industry, Soils, and Agricultural Engineering. It consists of several more or less broken leaves, together with numerous leaf fragments (Fig. 1, *D*, *a–d*). These leaves are definitely those of *Viola odorata*.[6] On a slip of paper within the packet is written in Dr. Galloway's hand:[7] "Soft or brown spot, Garrett Park." Penciled on the outside of the packet appears: "Called wart . . . may follow insect bites."[8] The name "oedema," which does not appear on the specimen, was original with Dr. Woods, as he has explained to the writer. In lieu of the exact date of collection, it seems reasonable to assume that it was between the years 1897–99: By 1897 a violet crop had been harvested as shown by Galloway's encouraging statement of the price received for blooms of the variety Lady Hume Campbell during the 8-month period October 1897–May 1898 (*5*, ed. 1, p. 223; ed. 2, p. 232; ed. 3, pp. 256–257); by 1899 Galloway's book was published, and, as indicated by the preface to the first edition, he was no longer connected with the violet-growing venture at Garrett Park.

Among the trio, Galloway, Dorsett, and Woods, it befell Dr. Woods as physiologist to take the lead with respect to the "oedema" as it appeared in the violet house at Garrett Park. The serious problem confronting them was to determine practical means of holding the diease in check. This Dr. Woods accomplished, and investigation into the cause of the disease was not pursued further.

Since the autumn of 1932, when violet scab first came to the attention of Massey, White, and Jenkins (*12*) through an outbreak of the disease in field plantings in Pennsylvania and New York, it has been found that the disease is more or less generally distributed throughout the District of Columbia area and not only at Garrett Park. This is shown by herbarium specimens presented in Fig. 1, *A*, which illustrates the disease on *Viola odorata* from a garden in Arlington, Va. (Fig. 1, *A*, *a*); on a wild violet hybrid (*V. affinis* Le Conte × *V. papilionacea* Pursh) growing naturally in a glade in Rock Creek Park, Md. (Fig. 1, *A*, *b*), and on blue marsh violet (*V. cucullata* Ait.) from the District of Columbia (Fig. 1, *A*, *c*). Norton's (*13*, p. 117) report of an unidentified disease of violet in Maryland (place undesignated) in 1909 suggests a stil

---

[6] Verification kindly made by Dr. S. F. Blake, Division of Plant Introduction and Exploration, Plant Industry Station, Beltsville, Md.

[7] Handwriting verified by Dr. Woods.

[8] Handwriting of Mrs. F. W. Patterson, who joined Dr. Galloway's staff in 1895 (*8*).

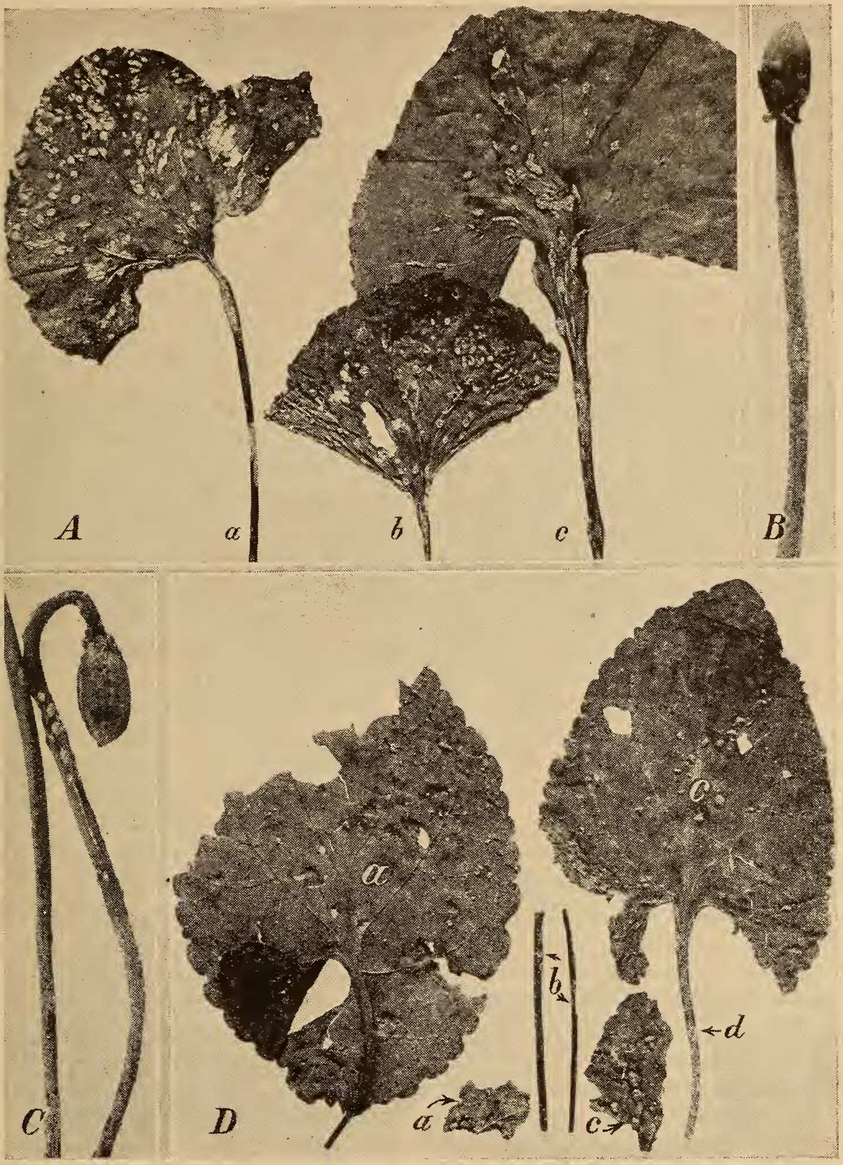

Fig. 1.—*A*, Dry pressed specimens of scab of violet representing gatherings made in the open in the District of Columbia area: *a*, sweet violet, upper leaf surface, from a garden in Arlington, Va., October 24, 1941, N. Rex Hunt; *b*, wild violet hybrid, folded parts of leaf representing lower leaf surface, Rock Creek Park, Md., October 12, 1935, J. A. Stevenson; *c*, lower leaf surface of blue marsh violet from a garden, District of Columbia, October 7, 1939, A. E. Jenkins. *B* and *C*, Fresh infected blossom stalks and capsules from same source as *A*, *c*, October 16, 1935, W. T. Swingle. *D*, "Oedema" of sweet violet: *a*, lower leaf surface; *b*, lesions on petioles; *c*, upper leaf surface; *d*, single lesion on petiole, Garrett Park, Md., 1897–1899 (see explanation in text), B. T. Galloway. All natural size. Photographs *A* and *D* by R. L. Taylor and *B* and *C* by M. L. F. Foubert.

earlier record of violet scab. Thus it reads: "Watery pimples on leaf R [symbol for 'rare'], cause (?), perhaps insect."

In the autumn of 1932, the only fresh material of scab of violet that the writer had seen consisted of diseased specimens of cultivated violet, variety Freys Fragrant, from Pennsylvania (*11*, p. 1 and pl. 1, *A–D*, and pl. 2, *A–D*, *E*, and *F*). At that time the same gathering of fresh specimens obtained for the purpose were shown to Dr. Galloway and then to Mr. Bissett, and later described to Dr. Woods. Still more recently Dr. Woods has been shown the published illustrations just cited as well as herbarium specimens. Upon seeing the specimens Dr. Galloway turned to the illustration of "oedema" in his book, but he was not certain that this was the disease affecting the violets from Pennsylvania. At the moment he could not recall that the "oedema" affected other organs of the plant than leaves. The writer remarked that, since the disease of Freys Fragrant was caused by *Sphaceloma,* it should resemble anthracnose of grape caused by a fungus of the same genus. Galloway, who was thoroughly conversant with this grape disease, then observed that, actually, the symptoms of the "oedema" resembled those of grape anthracnose.

From the writer's description of the scab on Freys Fragrant, Dr. Woods did not recognize this disease as the same as that he had known as "oedema." More recently, when he saw specimens of the disease on Freys Fragrant, he still found it different in appearance from the "oedema" he had known at Garrett Park, i.e., as illustrated in Galloway's book. Dr. Woods and the writer reviewed various specimens of violet scab, such as those here illustrated (Fig. 1, *A–C*), and finally concluded that the marked difference in the leaf spot on Freys Fragrant as compared with that of the "oedema" might be explained on the basis of the reaction of the two different sweet violet varieties to infection by the *Sphaceloma.* No physiological disturbance that might truly be called oedema was known to Dr. Woods, and none has been found by the writer in the literature on violet diseases.

On Freys Fragrant initial infection often occurs on the lower leaf surface, thus accounting for the leaf spot being generally more conspicuous on that side of the leaf. Violet scab blade lesions may be surrounded by a deep green border and this is particularly noticeable on the flattened to moderately bulged Freys Fragrant leaf spot (*11*, pl. 1, *D*, and pl. 2, *F*). The Galloway specimen, shows numerous raised, hyperplastic lesions on the upper surface, together with occasional vein lesions, and two vein lesions are distinguishable near the base of the blade illustrated by Galloway. Among the three leaves illustrated in Fig. 1, *A*, the third (*c*) shows lesions practically limited to the veins below. Clearly, this infection originated on the lower leaf surface, where the symptoms are the more prominent. Similarly, on the leaf illustrated in Fig. 1, *A*, *b*, where the lesions are chiefly interveinal, initial infection was correspondingly limited to the lower leaf surface. Inspection of the leaf of *Viola odorata* shown in Fig. 1, *A*, *a*, as well as of other leaves from the same source, reveals that initial infection must have taken place on both blade surfaces: thus there are lesions of equal prominence and appearance on either side of the leaf.

Returning to the Galloway specimen and the representative illustration, it may be discerned that the more prominent lesions evidently represent infection on the upper leaf surface. A similar instance of leaf spots bulged below and raised above resulted in the case of a related disease, namely, lima bean scab, when leaves were artificially inoculated with the pathogene of that disease (*1*, Fig. 1, *A*, *B*). In artificial inoculations on leaves of the variety Princess Mary these proved to be more susceptible to infection on the lower, rather than the upper blade surface (*11*, p. 8, pl. 4, *A*). The culture used as inoculum was from violets, probably of the variety Mrs. David Lloyd George, grown on the Hudson, i.e., at Rhinebeck, N. Y.

Among all those who saw the fresh severely diseased specimens of Freys Fragrant in 1932, Mr. Bissett was the only one to whom the disease was familiar. With his broad knowledge of violets he at once named the particular variety and as quickly recognized the malady. Essentially, his statement was as follows:

"The disease is what has been called 'oedema.' Stems and blossom stalks, as well as leaves, may be affected. When the trouble is present, cultural conditions are unfavorable. Cold, too much moisture, and poor ventilation are environmental conditions favorable to the disease. I have received specimens from various places; once I took a specimen to Dr. E. F. Smith, who told me that the disease was caused by a fungus."

More recently, Mr. Bissett has stated that when Galloway and Dorsett were contending with the "oedema" at Garrett Park, violet growers on the Hudson also were having to deal with it. He offered the further information that when he acquired the violet houses at Garrett Park he removed the partitions, thus improving air circulation, and exercised particular care to keep the plants dry, and in this way completely eliminated the disease. Mr. Bissett stated also that he had observed the "oedema" on wild violets in a woodland near Garrett Park.

In critical examinations of *Sphaceloma violae* Jenkins, as the pathogen of violet scab is designated (*11*, p. 7), the writer has found it more satisfactory to examine petiole rather than blade lesions for hyphal fragments, stromata, and also conidia. Following this plan in the examination of the Galloway specimen, microscopic preparations were made from scrapings from the delicate petiole lesions (Fig. 1, *D*, *b* and *d*). A few hyphal fragments, together with a number of conidia recognizable as of the *Sphaceloma*, were found in these mounts.

A summary of the known distribution of violet scab (*10*) shows that the disease now has been found in this country in all coastal states from Massachusetts to Texas, except Delaware[9]; outside the United States its known geographic range includes New South Wales in Australia, and the Union of South Africa, in Africa.

LITERATURE CITED

(*1*) Bruner, S. C., and Jenkins, Anna E. *Identity and host relations of the* Elsinoë *of lima bean.* Journ. Agr. Res. **47**: 783–789. 1933.

(*2*) Coon, N. *Practical violet culture.* 127 pp. New York, 1925.

(*3*) Dorsett, P. H. *Spot disease of the violet* Alternaria violae *n. sp.* U. S. Dept. Agr. Div. Veg. Phys. and Path. Bull. 23, 16 pp. 1900.

(*4*) Galloway, B. T. *Report of the chief of the Division of Vegetable Physiology and Pathology,* pp. 169–174. *In* Rept. Sec. Agr. for fiscal year ended June 30, 1895, 174 pp. Washington, 1895.

(*5*) ———. *Commercial violet culture: A treatise on the growing and marketing of violets for profit,* 244 pp. New York, 1899. (Ed. 2, 239 pp., 1903; ed. 3, 244 pp., 1914).

(*6*) ———. *Report of the chief of the Bureau of Plant Industry* (pp. 47–108). *In* Rept. Sec. Agr. for fiscal year ended June 30, 1902, 402 pp. Washington, 1902.

(*7*) ———. *Violet growing as a business.* Country Life in America **5**: 233–237. 1904.

(*8*) ———. *Flora W. Patterson 1847–1928.* Phytopathology **18**: 877–879. 1928.

(*9*) Gregory, C. T., and Davis, J. J. *Common garden pests: What they are and how to control them,* 150 pp. Des Moines, Iowa, 1928.

(*10*) Jenkins, Anna E. *Additional records of violet scab.* (Phytopathological note.) Phytopathology **33**: 168–169. 1943.

(*11*) Massey, L. M., and Jenkins, Anna E. *Scab of violet caused by* Sphaceloma. Cornell Univ. New York Agr. Exp. Stat. Mem. 176, 9 pp. 1935.

(*12*) ———, White, R. P., and Jenkins, Anna E. *Disease of cultivated sweet violet caused by* Sphaceloma. (Abstract.) Phytopathology **23**: 22–23. 1933.

(*13*) Norton, J. B. S. *Report of Committee on Botany and Plant Pathology: Plant diseases for 1909.* Proc. Ann. Meeting State Hort. Soc., pp. 106–117. 1909.

(*14*) Saltford, H. *The violet revival.* House and Garden **78**: 30, 50. 1940.

(*15*) True, A. C. *A history of agricultural experimentation and research in the United States 1607–1925, including a history of the United States Department of Agriculture.* U. S. Dept. Agr. Misc. Publ. 251, 321 pp. 1937.

(*16*) Wood, A. S. *Beverly Thomas Galloway: Born October 16, 1863—Died June 13, 1938.* Science **88**: 6. 1938.

---

[9] The presence of violet scab in Louisiana was ascertained when Dr. M. A. Petty, formerly of the Southwestern Louisiana Institute, Lafayette, La., remarked upon seeing illustrations that he was familiar with this same disease as affecting wild violet on the horticultural farm of the Institute. Specimens had been collected a number of times during class excursions, he said, but remained unidentified.